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AUTHOR Purdy, Leslie, Comp.
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ABSTRACT

These instructional objectives, written by Ronald Gibson have been selected from materials used at Golden West College (California). These objectives are offered simply as samples that may be used where they correspond to the skills, abilities, and attitudes instructors want their students to acquire. These objectives may also serve as models for assisting instructors to translate their courses into specific measurable terms. For other objectives in related courses see: ED 033 688 (Chemistry [first semester]); ED 033 696 (Geology); and ED 033 710 (Physics [first semester]). (MB)

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# Instructional Objectives for a Junior College Course in Basic Physical Science

Physical Science 100
Instructor: Ronald Gibson
Golden West College
Huntington Beach, California

JC 720 206

UNIVERSITY OF CALIF.
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Leslie Purdy, Compiler
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GOLDEN WEST COLLEGE

Course: Physical Science 100, Basic Physical Science

Instructor: Ron Gibson

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## STUDY GUIDES

The following study guides will be your most valuable aid in preparing for weekly quizzes and hour-exams. The study guides are a condensation of the most important material covered in each of the chapters and accompaning lectures. In addition, they list all of the specific items which will be covered on quizzes and exams. You will notice before each of the items listed there are two numbers in parenthesis. These numbers refer respectively to the chapter number and the specific study objective. Every quiz and exam question asked will also have a two-number key in front of the question which matches with the particular study objective. Hence, the following study guides provide you with those items which the instructor considers most important and which will be given during testing. This should enable you to concentrate your studying into specific areas and minimize the amount of "out-guessing the prof". Since we will not have sufficient time to cover all of the chapters within your textbook, the study guides for those chapters to be omitted are not included.

STUDY GUIDE - Chapter 1 (Motion)

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After completion of Chapter 1 and review of associated material presented in the lecture, you should be able to:

PLANETARY MOTION

(1 - 1) 1. Select the pattern of motion for stars in the northern horizon.

A. Select the cause of this pattern

B. Correlate the movement of the sun and moon with this pattern of motion

(1 - 2) 2. Account for the relative eastward drift of the sun, moon and planets when viewed against the stars.

(1 - 3) 3. Outline the two possible models of the solar system based on visual observations made without telescopes (assuming a fixed earth and a rotating earth)

SPEED AND VELOCITY

(1 - 4) 1. Define speed and velocity. Contrast the two concepts.

(1 - 5) 2. Express velocity in terms of its proportional and inversely proportional relationship to distance and time respectively.

(1 - 6) 3. Given a problem with any two of v, d, and t; solve for the third.

ACCELERATION

(1 - 7) 1. Define acceleration in descriptive terms and with an equation.

(1 - 8) 2. Given a set of values, solve for the acceleration of an object.

(1 - 9) 3. List the values for gravitational acceleration in both metric and English units.

(1 - 10) 4. Assuming ideal conditions of free fall, calculate velocity of an object t seconds after it has been dropped, thrown upward or downward.

(1 - 11) 5. Assuming standard values of g, calculate the acceleration of an object at time t after being dropped or thrown under conditions of free fall.

ACCELERATION, SPEED AND DISTANCE

(1 - 12) 1. Calculate the final velocity of an object undergoing acceleration.

(1 - 13) 2. Given the acceleration, calculate the distance an object will travel in time t.

PROBLEMS

(1 - 14) 1. Convert quantities given in one set of units to those in another set of units.

(1 - 15) 2. Work out and correctly answer problems 3, 4, 5, 7, 9, 11, 13 - pp. 28 & 29.

STUDY GUIDE - Chapter 2 (Force and Motion)

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After completion of Chapter 2 and reviewing associated material presented in the lecture you should be able to:

INERTIA

(2-1) 1. State Newton's first law of motion. Be familiar with the concept Newton was defining with his first law of motion.

(2-2) 2. Define and contrast weight and mass.

FORCE

(2-3) 1. Define force in terms of motion.

(2-4) 2. Discuss the relationship between force and acceleration.

(2-5) 3. State Newton's second law of motion.

(2-6) 4. Given any two values of F, m, and a: solve for the third. Given initial and final velocity, time and mass, solve for the force producing acceleration.

MASS AND WEIGHT

(2-7) 1. Given any mass; calculate the corresponding weight (in the metric system).

(2-8) 2. Given any two values of weight, force and acceleration, calculate the third (by first converting weight to mass.)

ACTION AND REACTION

(2-9) 1. State Newton's third law of motion.

(2-10) 2. Identify and distinguish between common examples of any of Newton's three laws of motion.

VECTORS

(2-11) 1. Contrast scalar and vector quantities.

(2-12) 2. Use vector addition methods in solving problems.

PROBLEMS

(2-13) 1. Solve problems 1,2,3,7,9, and 15: pp. 50-51.

(2-14) 2. Solve any problems using equations listed in Chapter 2.

STUDY GUIDE - Chapter 3 (Gravitation)

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After completion of Chapter 3 and reviewing associated material presented in the lecture, you should be able to:

CIRCULAR MOTION

(3-1) 1. Define and contrast centripetal and centrifugal force.

(3-2) 2. Discuss the relationship of centripetal force to mass, velocity and radius.

(3-3) 3. Solve for centripetal force given values of M, v, and r.

UNIVERSAL GRAVITATION

(3-4) 1. State the law of universal gravitation.

(3-5) 2. Discuss the effect of changing the value of mass and radius on gravitational force.

(3-6) 3. Given examples of hypothetical planets with either different masses or different radii than the earth, select the change in gravitational force relative to that of the earth.

(3-7) 4. Define the orbits of the planets in terms of the balance between centrifugal force and gravitational force.

(3-8) 5. Give the name of the worker and the type of experiment which proved the validity of the law of universal gravitation.

THE EARTH'S GRAVITY

(3-9) 1. Discuss the true shape of the earth and account for the departure from a perfectly spherical shape.

(3-10) 2. List the various factors which can effect the value of gravitational force on the earths surface and the exact effect of changing each of these factors.

(3-11) 3. Outline a simple method for "weighing" the earth.

(3-12) 4. Give the origin of the ocean and earth tides in terms of the inter-relationship of the earth, moon, and sun.

OMIT PAGES 68 - 72

PROBLEMS

Solve problems 1,7,9, and 11: p. 73.

STUDY GUIDE - Chapter 4 (Energy and Momentum)

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After completion of Chapter 4 and review of associated material presented in the lecture, you should be able to:

WORK

(4-1) 1. Define work in both descriptive terms and by means of an equation.

(4-2) A. Solve for W given: F and d or information from which you can solve for F.

(4-3) B. Give the metric unit for work.

(4-4) 2. Define power and contrast it with work.

(4-5) A. Solve for P given W and t or data from which W can be obtained.

(4-6) B. List the metric unit for power.

ENERGY

(4-7) 1. Give a descriptive definition of energy.

(4-8) 2. Define kinetic energy and why it is capable of doing work.

(4-9) A. Identify the equation for kinetic energy and given 2 of the 3 variables in the equation, solve for the third.

(4-10) B. From a list of alternatives, pick the example of kinetic energy.

(4-11) 3. List the equation for and the definition of potential energy.

(4-12) A. Contrast potential and kinetic energy.

(4-13) B. Given values of M and h or data which allow their determination; calculate PE.

(4-14) C. Using the relationship resulting from the conversion of potential to kinetic energy, determine the velocity of an object undergoing such a change.

(4-15) D. Discuss how the reference level used in calculating PE renders the energy a relative quantity. Given a constant mass with several reference levels calculate the various values of PE.

Study Guide Ch. 4 continued

MOMENTUM

(4-16) 1. List the two varieties of momentum.

(4-17) 2. Define linear momentum, in both descriptive terms and by equation.

(4-18) A. Discuss examples of conservation of momentum.

(4-19) B. Given 3 of the 4 variables involved when two objects collide; solve for the 4th.

(4-20) 3. Discuss the relationship between distribution of mass and conservation of angular momentum.

CONSERVATION OF ENERGY

(4-21) 1. List the more common varieties of energy and discuss how one type of energy can be converted into another.

(4-22) 2. List that particular form of energy which is the origin for all energy forms other than nuclear energy and that form which is the ultimate end product of all energy.

(4-23) 3. Outline the concept of entropy and its ultimate meaning with regard to the solar system.

(4-24) 4. Discuss how Joule's experiment with heat relates to the conservation of energy.

(4-25) 5. State the law of the conservation of energy.

HEAT

(4-26) 1. Contrast heat and temperature.

(4-27) 2. Given a temperature in either the Fahrenheit or Centigrade (Celsius) scales - convert to the other scale.

(4-28) 3. Define a calorie and kilocalorie.

(4-29) 4. Discuss what actually occurs in terms of heat transfer when we heat something up or cool it off.

(4-30) 5. Contrast the specific heat of water with other substances and what this means regarding the insulating effect of water.

(4-31) 6. Define heat and list the 3 ways in which heat is transferred.

PROBLEMS

(4-32) 1. Solve the following problems: 1,3,5,6,7,8,12,17, pp. 100-101.

STUDY GUIDE - Chapter 6 (Kinetic Theory of Matter)

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After completion of Chapter 6 and reviewing associated material presented in class, you should be able to:

KINETIC THEORY OF MATTER

(6-1) 1. List the two basic assumptions of the Kinetic-molecular theory.

(6-2) 2. Give the term used for the irregular constant movement of molecules.

(6-3) 3. Discuss the gas laws in terms of the Kinetic-Molecular Theory.

(6-4) A. Outline the relationship of volume to pressure as defined by Boyle's Law. Given initial conditions of pressure and volume - predict the result of changing the pressure or volume.

(6-5) B. Outline the relationship of volume to temperature as defined by Charle's Law. Given initial conditions of volume and temperature, predict the result of changing either factor.

(6-6) C. Given the equation for the ideal gas law; predict the effect on each of the variables as the other variables are changed.

(6-7) D. Give the value (in degrees centigrade) of absolute zero. Describe the motion of molecules at absolute zero.

(6-8) 4. List the 4 basic assumptions of the kinetic theory for gas molecules.

(6-9) A. Explain Boyle's and Charle's laws on basis of the 4 assumptions made in the kinetic theory.

(6-10) B. Using the average kinetic energy of a molecule ($KE = \frac{1}{2}mv^2$) illustrate why, at the same temperature, heavy molecules will be moving slower than light molecules.

(6-11) C. Given the atomic weight of two or more gases, select the gas that - at a constant temperature - will have the highest velocity.

Study Guide - Ch. 6 continued

HEAT

(6-12) 1. List the 3 types of molecular motion.

(6-13) 2. Define Heat in terms of molecular behavior and give the type of molecular motion resulting in heat.

(6-14) 3. Correlate between gas-liquid-solid states and strength of attractive forces for molecules in each state.

(6-15) 4. Discuss the behavior of molecules in changing from one state to another (vaporization-boiling-freezing).

(6-16) A. Account for the fact that water derived from melting ice will remain at 0° C. until <u>all</u> the ice is melted.

(6-17) B. Account for the fact that the temperature of boiling water remains at 100°C until all the water is boiled off.

SECOND LAW OF THERMODYNAMICS

(6-18) 1. State the second law of thermodynamics and relate the law to the concept of entropy.

(6-19) 2. Illustrate how the heat engine operates based on kinetic-molecular behavior and a difference in temperature between two objects or places.

PROBLEMS

(6-20) 1. Solve problems 1,3,5, and 7: pp. 149-150.

## STUDY GUIDE - Chapter 7 (Electricity)

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After completion of Chapter 7 and reviewing associated material presented in the lecture, you should be able to:

### ELECTRIC CHARGE

(7-1) 1. Define and contrast conductors and insulators.

(7-2) 2. Account for a given object being a good conductor (or a good insulator).

(7-3) 3. Relate electric charge to electron "flow" and define electric charge.

(7-4) 4. State Coulombs Law.

(7-5) A. Relate electric force to magnitude of charges and distance between charges.

(7-6) B. Compare Coulomb's Law to the law of universal gravitation.

### FORCE FIELDS

(7-7) 1. Compare the force fields produced by electricity, magnetism, and gravitation.

### THE ELECTRON

(7-8) 1. Place the electron in its proper position within an atom.

(7-9) 2. Discuss the role of ionization with regard to the flow of electricity in a gas or liquid.

(7-10) 3. Account for the phenomena of induction by electron behavior.

(7-11) 4. Give the relative importance of the mass to the charge of electrons.

### PROBLEMS

(7-12) 1. Solve problem 3, p. 174.

STUDY GUIDE - Chapter 8 (Currents and Magnetic Fields)

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After completion of Chapter 8 and reviewing associated material presented in the lecture, you should be able to:

ELECTRIC CURRENT

(8-1) 1. Define an electric current and the unit used to express electric current.

(8-2) A. Give the equation (or definition) for the unit of electric current.

(8-3) B. Draw an analogy between the potential difference (or voltage) of electrcity and the behavior of flowing water in a pipe.

(8-4) 2. State Ohms law.

(8-5) A. Given any 2 values of v, R, or i; solve for the third.

(8-6) B. Draw an analogy between Ohms law and the flow of water in a pipe.

(8-7) 3. Define electrical power and compare to mechanical power.

(8-8) 4. From the equation for electrical power, solve for the 3rd variable given the values of the other 2 variables.

MAGNETISM

(8-9) 1. Outline the properties of magnets.

(8-10) 2. Explain the significance of Oersted's experiment.

(8-11) 3. Explain the significance of Faraday's experiments with conductors and magnets.

(8-12) A. Define an induced current.

(8-13) B. Outline the manner in which electric current is produced through the dynamo effect.

(8-14) 4. List all possible methods of producing an electric current.

(8-15) 5. Give the purpose of a transformer and the manner in which it functions.

PROBLEMS

(8-16) 1. Solve problems 1, 5, 6, 7 on page 202.

STUDY GUIDE - Chapter 10 (Basic Chemistry)

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After completion of Chapter 10 and review of associated material, the student should be able to:

CHEMICAL CHANGE

(10-1) 1. Define a chemical reaction.

(10-2) 2. Distinguish between homogeneous and heterogeneous materials.

ELEMENTS, COMPOUNDS, AND MIXTURES

(10-3) 1. Define and contrast an element and a compound.

(10-4) 2. Distinguish between homogeneous and heterogeneous mixtures.

(10-5) 3. List 3 tests used to distinguish homogeneous mixtures (solutions) from chemical compounds.

COMBUSTION

(10-6) 1. Outline the phlogiston theory.

(10-7) 2. State who disproved the phlogiston theory and how it was disproven.

(10-8) 3. Describe the two experiments used to establish the true nature of combustion and the implications drawn from each.

(10-9) 4. Give the present-day explanation of combustion.

LAW OF DEFINITE PROPORTIONS

(10-10) 1. State the law of definite proportions.

(10-11) 2. Predict in what proportions by weight two elements will unit to form a compound.

CONSERVATION OF MASS

(10-12) 1. State the law of the conservation of mass, as applies both before and after the advent of atomic energy.

(10-13) 2. How did Lavoisiers experiments prove the conservation of mass?

SYMBOLS AND FORMULAS

(10-14) 1. Combine elements into compounds with proper formulas given the number of atoms of each elements.

Study Guide - Ch. 10 continued

CHEMICAL EQUATIONS

(10-15) 1. Given a group of equations, select the one which is either balanced or unbalanced.

(10-16) 2. Balance given equations.

ATOMIC WEIGHT

(10-17) 1. State how atomic weight is defined.

(10-18) 2. Define a gram atom and give gram atom weight for any element.

MOLECULAR WEIGHT

(10-19) 1. Calculate the molecular weight of a given compound.

(10-20) 2. Define a mole (or gram-molecule) and give gram molecular weights for various molecules.

AVOGADRO'S NUMBER

(10-21) 1. Define Avagadro's number.

(10-22) 2. Apply Avagadro's number to gram-atoms and gram-molecules of substances by calculating the number of atoms or molecules within a given amount of the substance.

PROBLEMS

(10-23) 1. Solve problems 1,3,4,5,10 - pp. 256-257.

STUDY GUIDE - Chapter 11 (The Atomic Nucleus)

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After completion of Chapter 11 and review of associated materials presented in the lecture, you should be able to:

RADIOACTIVITY

(11-1) 1. Define spontaneous radioactivity.

(11-2) 2. Define alpha, beta and gamma rays, giving their charge, mass, and velocity.

(11-3) 3. Relate radioactive decay to emission of helium.

(11-4) 4. Define half-life and solve problems involving amount of grams remaining of radioactive materials given the half-life, number of years of decay and initial weight.

THE NUCLEUS

(11-5) 1. List the results of Rutherford's experiments in terms of structure of the atom and spatial relationships of the nucleus and electrons.

(11-6) 2. Define atomic number and identify the atomic number of a given element from the periodic table.

(11-7) 3. Define a proton and explain the relationship between protons and atomic weight.

(11-8) 4. Outline the experiment leading up to discovery of the neutron and list the properties (mass and charge) of neutrons.

(11-9) 5. Specify the relationship between isotopes and neutrons and define an isotope.

(11-10) 6. Discuss the effect of isotopes on chemical behavior of substances.

NUCLEAR ENERGY

(11-11) 1. Identify and list the components in the equation for nuclear energy - $E = MC^2$.

(11-12) A. Outline how mass is converted into energy.

(11-13) B. Account for the "missing" mass of combining elements.

(11-14) 2. Define the term binding energy.

NUCLEAR ENERGY con't.

(11-15) 3. Define nuclear fission and fussion.

(11-16) A. Identify the relative energies of the two types of nuclear reactions.

(11-17) B. Outline the basic difference between the two reactions.

(11-18) C. Match the A-bomb and H-bomb with the appropriate type of nuclear reaction. List the sequence of events which occurs in the detonation of an H-bomb.

(11-19) D. Explain the type of radiation causing a "dirty" or highly radioactive type of bomb.

(11-20) E. Outline the process involved in a nuclear chain reaction and give the key to the generation of a chain reaction.

ELEMENTARY PARTICLES

(11-21) 1. List the functions and characteristics of mesons, antimatter and neutrinos.

(11-22) 2. Define antimatter and predict the product produced by a combination of matter and antimatter.

PROBLEMS

(11-21) 1. Solve problems 4, 8, 9 - p. 291.

STUDY GUIDE - Chapter 13 (The Periodic Law)

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After completion of Chapter 13 and review of lecture material, you should be able to:

THE PERIODIC LAW

(13-1) 1. State the periodic law and give its relation to atomic weight.

(13-2) 2. List the characteristics which distinguish a metal from a nonmetal, along with their position in the periodic table.

(13-3) 3. Define chemical activity and inactivity.

(13-4) 4. Relate activity to position on the periodic table.

(13-5) 5. List the common chemical families and their members.

(13-6) A. Outline the chemical characteristics of each of the families and the type of compounds they form.

(13-7) B. Give examples of how the families differ from each other in their chemical properties.

(13-8) 6. Discuss how the periodic table was constructed by periodic changes in chemical properties as functions of atomic weight.

(13-9) A. Define periods and groups and give their position on the table.

(13-10) B. State the percentage of metals and nonmetals in the periodic table.

ATOMIC STRUCTURE AND THE PERIODIC LAW

(13-11) 1. Account for the position of elements in the periodic chart by means of their electron configurations.

(13-12) 2. Define open versus closed shells.

(13-13) 3. Correlate chemical activity to electron number and distribution.

(13-14) 4. Given an element, state the number of electrons in its outer shell.

CHEMICAL BONDS

(13-15) 1. Distinguish covalent from ionic bonding and define each in terms of electron behavior.

## Study Guide - Ch. 13 (The Periodic Law)

**CHEMICAL BONDS con't.**

(13-16) 2. Account for the origin of ions by electron transfer. Define positive or negative ions on the basis of their outer electron behavior.

(13-17) 3. Correlate chemical activity, outer electron configuration and position on the periodic table.

**VALENCE**

(13-18) 1. Define valence.

(13-19) 2. Outline the relationship between valence and electron configuration of the outer electron shell for any given element.

(13-20) 3. List the valence of individual elements within any given compound.

(13-21) 4. Given the valences of two elements, list the formula of the resulting compound.

(13-22) 5. List the valence of the sulfate and nitrate groups.

**QUESTIONS**

(13-23) 1. Answer questions 1,3,5,12,14 and 15: pp. 349-350.

## STUDY GUIDE - Chapter 15 (Chemical Reactions)

After completion of Chapter 15 and review of associated materials presented in the lecture, you should be able to:

### CHEMICAL ENERGY

(15-1) 1. Define endothermic and exothermic reactions and identify endothermic and exothermic reactions from given examples.

(15-2) 2. Correlate stability of compounds with their endo-exothermic properties.

(15-3) 3. Explain chemical energy in terms of potential energy of electrons.

(15-4) 4. List the common fuels and the products of the combustion of these fuels.

(15-5) 5. Relate the chemical energy released in reactions of common explosives with the chemical properties of nitrogen and list the products of a reaction involving nitrogen-explosives.

### REACTION RATES

(15-6) 1. List the effect on reaction rates of: temperature concentration, surface area and catalysts.

(15-7) 2. Give the 3 methods of changing equilibrium in a chemical reaction.

### OXIDATION AND REDUCTION

(15-8) 1. Define oxidation and reduction, in terms of the common definition and the more specific electron definition.

(15-9) 2. Distinguish displacement reactions from oxidation-reduction reactions.

(15-10) 3. Given a group of reactions, select the oxidation and reduction products.

### CHEMICAL ACTIVITY

(15-11) 1. Given a list of common metals or nonmetals, select the least (or most) active elements.

### VALENCE CHANGES

(15-12) 1. Explain valence changes in terms of oxidation and reduction.

Study Guide - Ch. 15 (Chemical Reactions)

VALENCE CHANGES con't.

(15-13) 2. Given examples, list the valence changes involved.

(15-14) 3. Distinguish ferric from ferrous valences in iron compounds and give the chemical reaction representing the rusting of iron.

QUESTIONS AND PROBLEMS

(15-15) 1. Answer questions 5,6,9,10,: p.405

(15-16) 2. Solve problems 1,3,6,7,9: pp. 405-406

STUDY GUIDE - Chapter 17 (Earth Materials)

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After completion of Chapter 17 and related material presented in the lecture you should be able to:

CRUST

(17-1) 1. List the 5 most abundant elements (in order of their abundance) making up the earth's crust.

(17-2) 2. Discuss the importance of silicon and silicon compounds in the crust.

(17-3) 3. List the "building block" of most minerals (and therefore the crust) and the most common group of minerals.

(17-4) 4. List the remaining mineral groups.

MINERALS

(17-5) 1. Define a mineral, including all of the characteristics necessary for distinguishing minerals from other compounds and from each other.

(17-6) 2. Define and explain the existance of mineral cleavage.

(17-7) 3. Contrast and account for crystalline versus amorphous minerals.

(17-8) 4. List the common rock forming minerals, including characteristic properties of those discussed in the lecture.

IGNEOUS ROCKS

(17-9) 1. List the three main groups of rocks.

(17-10) A. Discuss the origin of each major type.

(17-11) B. Discuss textural differences between the three groups.

(17-12) 2. Correlate the various igneous rock textures with mode of origin- particularly depth and time of cooling.

Study Guide - Ch. 17 (Earth Materials)

IGNEOUS ROCKS con't.

(17-13) A. Outline the textures to be expected in deep intrusive, shallow intrusive, extrusive and pyroclastic rocks.

(17-14) B. Define the textural terms: aphanitic, porphyritic, equigranular, glassy and pyroclastic.

(17-15) 3. Define the terms basic and acidic (chemically and mineralogically).

(17-16) 4. Contrast intrusive and extrusive rocks from a textural standpoint. Given a group of igneous rocks select the intrusive or extrusive rock.

SEDIMENTARY ROCKS

(17-17) 1. List the two main groups of sedimentary rocks.

(17-18) A. Contrast the textures of the two groups.

(17-19) B. Contrast the mode of origin of the two groups.

(17-20) 2. List, in order, the main fragmental sedimentary rock types as defined by grain size.

(17-21) 3. Discuss the genetic significance of : breccia, arkose, graywacke.

(17-22) 4. List the main types of sedimentary precipitates.

METAMORPHIC ROCKS

(17-23) 1. Contrast contact versus regional metamorphic rock types and origins.

(17-24) 2. List the steps through which a clay goes in becoming a gneiss (in order).

(17-25) 3. Define a metamorphic facies and give the origin of facies.

(17-26) 4. Give the metamorphic equivalents of limestone and sandstone. List the textural changes that occurred in the metamorphism of these rock types.

(17-27) 5. Define and give the origin of foliation.

OMIT - SECTION ON SOIL

STUDY GUIDE - Chapter 18 (Atmosphere and Hydrosphere)

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After completion of Chapter 18 and review of associated material presented in the lecture you should be able to:

THE ATMOSPHERE

(18-1) 1. List the two main components of the atmosphere and their relative abundance.

(18-2) 2. Account for the lack of hydrogen and helium in our atmosphere.

(18-3) 3. Outline the oxygen-carbon dioxide cycle.

(18-4) 4. Outline the pressure-temperature distribution up to a distance of 300 miles from the earth's surface.

(18-5) 5. List the various subdivisions of the atmosphere, in the order of their occurrance.

(18-6) 6. Discuss the role of the ionosphere in radio communication.

METEOROLOGY

(18-7) 1. Define weather and climate.

(18-8) 2. List the various factors which cause temperature differentials within the earth's atmosphere.

(18-9) 3. Define the terms humidity and saturation and discuss how moisture content varies with temperature.

(18-10) 4. Describe a simplified pattern of global wind circulation.

(18-11) 5. Contrast warm versus cold fronts.

(18-12) 6. Outline the chief driving mechanisms of local atmosphere circulation.

THE OCEANS

(18-13) 1. List the various subdivisions of ocean basins based on bottom topography.

(18-14) 2. Discuss the configuration of the ocean bottom with emphasis on total amount of relief and submarine canyons.

THE OCEANS con't.

(18-15) 3. Discuss the role of turbidity currents in oceanic erosion and deposition.

(18-16) A. Give the triggering mechanism of turbidity currents.

(18-17) B. List the physical and geologic evidence for turbidity currents.

(18-18) 4. Outline the causes of ocean currents.

STUDY GUIDE - Chapter 19 (The Changing Crust)

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Upon completion of Chapter 19 and review of associated material presented in the lecture, you should be able to:

WEATHERING

(19-1) 1. List the two types of weathering and processes operating in each.

(19-2) 2. Discuss the relationship between rock type and climate.

(19-3) A. Contrast weathering processes in tropical versus desert areas.

(19-4) B. Given a number of rock types, select the most or least resistant under tropical weathering conditions.

(19-5) C. Name the natural acid formed from the combination of $CO_2$ and water.

(19-6) D. Name the type of soil which results from chemical weathering in a tropical climate and the material from which aluminum is extracted.

EROSION & SEDIMENTATION

(19-7) 1. List the various agencies of erosion and sedimentation

(19-8) 2. Discuss landslides in Southern California, particularly the factors which control sliding.

(19-9) 3. Discuss the importance of groundwater in arid regions, such as Southern California. Describe the manner in which groundwater moves.

(19-10) 4. Discuss denudation rates and their relationship to the level of continents as well as upward acting forces in the crust.

VOLCANOES & INTRUSIVE ROCKS

(19-11) 1. Account for the origin of liquid lava from the solid mantle and crust of the earth.

(19-12) 2. Contrast the shapes of volcanoes consisting of basalt and rhyolite. Explain how the composition of lava controls the shape of a volcano.

(19-13) 3. List the various types of volcanic products produced by extrusion of lava onto the surface and into the atmosphere. Select the destructive agents in the Mount Pelee and Krakatas eruptions.

(19-14) 4. Outline the distribution of volcanoes in the world and list the main volcano belts in the world.

(19-15) 5. List and define the various intrusive features.

DIASTROPHIC MOVEMENT

(19-16) 1. List and define the different types of faults.

(19-17) 2. Discuss the location, type of movement, amount of movement and sense of offset along the San Andreas fault.

(19-18) 3. Define and discuss isostacy.

(19-19) A. Given examples of regional uplife and down warping with historic time.

(19-20) B. Explain what such regional movements of the crust infer about the state of the crust and underlying mantle.

(19-21) 4. Define a rheid substance and explain how the crust can behave as both a solid and a fluid.

(19-22) 5. List and define the various types of folds.

MOUNTAIN BUILDING AND GEOSYNCLINES

(19-23) 1. Define a geosyncline.

(19-24) 2. Outline the evolution from geosyncline to mountain range.

(19-25) 3. Account for the thick accumulation (10,000's feet) of shallow water limestone in a geosyncline.

(19-26) 4. Discuss the correlation between geosynclines and island arcs.

(19-27) 5. Define granitization.

(19-28) A. Predict where and when granitization will occur in the transformation of a geosyncline to a mountain range.

(19-29) B. List the end products of granitization as well as the initial materials and intermediate stages.

STUDY GUIDE - Chapter 20 (Within The Earth)

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After review Chapter 20 and associated material presented in the lecture you should be able to:

EARTHQUAKES

(20-1) 1. Discuss how natural earthquakes are generated and give the evidence for the elastic-rebound theory.

(20-2) 2. Name the scale used to express earthquake magnitude and define the scale in terms of the correspondence between number on the scale with amplitude and energy.

(20-3) 3. Select the scale used to indicate earthquake intensity, give the basis for the scale and contrast intensity with magnitude.

(20-4) 4. List the major earthquake belts in the world and compare with the earth's volcanic belts.

(20-5) 5. Discuss the 3 types of earthquake waves produced in faulting.

(20-6) A. Compare their relative velocities.

(20-7) B. Compare their configuration.

(20-8) C. Outline the manner in which the epicenters of earthquakes are located.

(20-9) 6. List those factors which enter into earthquake damage along with the effect of each factor.

(20-10) 7. Discuss the probability of earthquakes accompanied by large scale damage occurring in California.

(20-11) 8. Define a Tsunami, give their origin, average velocity, maximum height and behavior in the open sea as well as near the coast.

INTERIOR STRUCTURE OF THE EARTH

(20-12) 1. Outline the various zones within the earth.

(20-13) A. Discuss the behavior of Pand S waves in each of the zones.

(20-14) B. Give the probable physical state for each zone.

(20-15) C. Account for the shadow zone produced during earthquakes.

(20-16) 2. Give the thickness and approximate composition of the oceanic and continental crust.

Study Guide - Ch. 20 (Within the Earth)

INTERIOR STRUCTURE OF THE EARTH continued

(20-17) 4. Discuss the temperature distribution within the earth.

(20-18) A. List the main source of heat from within the earth.

(20-19) B. Outline the probable history of earth heat.

(20-20) C. State the probable origin of high heat flow over oceanic ridges.

(20-21) D. Contrast theoretical versus observed heat flow for the continental and oceanic crust.

TERRESTRIAL MAGNETISM

(20-22) 1. Compare the orientation of the earths magnetic and geographic poles.

(20-23) 2. List the conditions probably responsible for the earth's magnetic field.

(20-24) 3. Describe the behavior of the earths magnetic field in historic time.

(20-25) 4. Discuss the geologic usefulness of fossil magnetism, including:

(20-26) A. The manner in which fossil magnetism is preserved.

(20-27) B. Present day findings of paleomagnetic studies.

(20-28) C. The correlation between paleomagnetism, mantle convection and continental drift.

SEA-FLOOR SPREADING AND CONTINENTAL DRIFT

(20-29) 1. Discuss sea-floor spreading.

(20-30) A. Give the location of upwelling and down-welling zones within the ocean basins.

(20-31) B. Cite evidence for sea-floor spreading.

(20-32) 2. Outline the probable mechanism operating in the mantle which is responsible for spreading.

(20-33) 3. Correlate continental drift with ocean floor spreading and mantle convection cells.

(20-34) 4. List the average rate of spreading (in centimeters per year).

(20-35) 5. Compare the oldest known oceanic crustal rocks with the oldest marine sedimentary rocks. Account for the resultant difference between the oldest age of the sea floor versus the oldest age of the oceans themselves.

STUDY GUIDE - Chapter 21 (History of the Earth)

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After completion of Chapter 21 and review of associated material presented in the lecture, you should be able to:

HISTORICAL GEOLOGY

(21-1) 1. Identify the three principal objectives the geologist has in studying earth history.

(21-2) 2. List the principal "tools" at the disposal of the historical geologist.

(21-3) A. Select the most important rock group in terms of use in historical geology.

(21-4) B. Define a fossil and give the basis for their usefulness to geologists.

DATING ROCK FORMATIONS

(21-5) 1. List the various methods of obtaining an absolute age date for a rock and discuss each.

(21-6) A. Select those elements used in determining radiometric dates.

(21-7) B. Given the half-life and the amount of mother-daughter elements, calculate the age of the mineral or rock.

(21-8) 2. List the various methods of obtaining a relative age date and discuss each.

(21-9) 3. List the 4 principles cited by your text as fundamental to interpreting the history of an area.

(21-10) 4. Identify the different types of unconformities.

(21-11) A. Outline how each is formed.

(21-12) B. Discuss how the age of an unconformity is obtained and how the unconformity represents a hiatus in time.

(21-13) 5. Given a geologic cross section-list the sequence of events, in order, as they occurred in the geologic history.

GEOLOGIC TIME SCALE

(21-14) 1. Outline how the geologic time scale was established. Give those qualities necessary for an organism to be a good index fossil.

(21-15) 2. List, in order, the 4 eras along with the predominant life forms for each era.

(21-16) A. Give the first and last periods (or epochs) for each era.

(21-17) B. Outline the biological record through time.

(21-18) 3. Give the length of time of the Pre-Cambrian together with its probable biologic history.

(21-19) A. Select the rock types normally associated with Pre-Cambrian formations.

(21-20) B. Locate the predominant areas of Pre-Cambrian rocks (the shield areas)

(21-21) 4. List those factors which will result in the creation of living matter from inorganic matter.

(21-22) 5. Discuss the evolution of life through the Paleozoic Era contrasting it with life forms immediately above and below.

(21-23) 6. Discuss the evolution of life through the Mesozoic Era contrasting it with life forms immediately above and below. Account for the extinction of the predominant life forms abruptly at the end of the Cretaceous Period.

(21-24) 7. Discuss the evolution of life through the Cenozoic Era contrasting it with Mesozoic organisms.

(21-25) 8. Give the duration of the Pleistocene (glacial age) along with the number of advances and retreats of continental glaciers.

(21-26) 9. List the age of man and the various stages of mans evolution from primate to "modern man".

ECONOMIC GEOLOGY

(21-27) 1. Discuss the origin of oil and coal.

(21-28) 2. List the various requirements for a good "reservoir" rock as well as the types of oil traps.

(21-29) 3. Outline and discuss the geologic occurrences of the metals and nonmetals which form the basis for our industrial society.

(21-30) 4. Discuss the long range availability of raw materials assuming a continued expansion of "industrial societies" on earth.

STUDY GUIDE - Chapter 22 (The Sun & Its Family)

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After reviewing Chapter 22 and associated material presented in the lecture you should be able to:

TELESCOPES

(22-1) 1. Identify the chief function of a modern telescope.

(22-2) 2. List the 3 most important sections of a modern stellar telescope.

PROPERTIES OF THE SUN

(22-3) 1. List the various zones within the sun, giving the characteristic properties of each zone (temperature, size, state of matter, atomic reactions or included radiation).

(22-4) 2. List the composition of the sun and compare to that of earth.

(22-5) A. Contrast the percentage of compounds and ions on the sun versus the earth and explain the difference.

(22-6) B. Discuss the lack of hydrogen and helium on earth in relation to escape velocity.

SOLAR ENERGY

(22-7) 1. Give the temperature at the suns interior.

(22-8) 2. Outline the proton-proton fusion reaction and the zone in which it occurs.

(22-9) 3. Define energy release in terms of $E = MC^2$ and state the origin of M in the equation.

SUNSPOTS

(22-10) 1. Account for dark nature of sunspots.

(22-11) 2. List temperature of sunspots and temperature of undisturbed solar surface.

(22-12) 3. Discuss the magnetic fields associated with sunspots.

(22-13) 4. Outline the clyclic nature of sunspot activity, giving the period of maximum activity and the effects on earth.

Study Guide - Ch. 22 (continued)

THE AURORA AND SOLAR ATMOSPHERE

(22-14) 1. List the cause of auroras and the atmospheric zone in which they occur.

(22-15) 2. Give composition and thickness of suns atmosphere.

SOLAR SYSTEM

(22-16) 1. Reconstruct the models of the solar system as put forth by Ptolemy, Copernicus and Kepler.

(22-17) 2. Explain Newton's contribution to astronomy.

(22-18) 3. Outline the distribution of planets in the solar system.

(22-19) A. List the planets in order, from the center of the solar system outward.

(22-20) B. Describe the orbits of the planets (shape, plane, motion, speed).

(22-21) C. Give the position of the main asteroid belt in the solar system.

MERCURY

(22-23) 1. Outline characteristic properties.

(22-24) A. Position, proximity to sun, relative size, temperature.

(22-25) B. Temperature as a function of period of revolution.

VENUS

(22-26) 1. List characteristic properties, including proximity to earth, size and mass, type and period of rotation.

(22-27) 2. Discuss surface temperature as a function of thick atmosphere and "greenhouse" effect.

MARS

(22-28) 1. Name the astronomer that studied mars and constructed the "canals".

(22-29) 2. List characteristic properties, including period of rotation, color, polar caps, meteor crators, temperature atmosphere.

Study Guide - Ch. 22 (continued)

JUPITER

(22-30) 1. List the characteristic properties, including relative size, period of rotation, satellites, mass.

(22-31) 2. Give density and relate to bulk composition.

SATURN

(22-32) 1. List characteristic properties, including size, density, rotation, rings, satellites.

(22-33) 2. Give the width, thickness and composition of Saturn's rings.

URANUS

(22-34) 1. Contrast the "tilt" or angle of Uranus' equator to its plane of orbit with that of other planets.

(22-35) 2. List average temperature and account for its extremely low nature.

(22-36) 3. Give length of Uranus year and number of satellites.

NEPTUNE

(22-37) 1. List period of revolution around sun and number of satellites.

PLUTO

(22-38) 1. Identify astronomer who prëdicted existance of Pluto.

(22-39) 2. Account for fact that at one point Pluto is closer to the sun than Neptune.

COMETS

(22-40) 1. Give location, number, composition.

(22-41) 2. Relate appearance in solar system to type of orbit and explain origin and behavior of comet "tails".

ASTEROIDS

(22-42) 1. Give the position of the asteroid belt in the solar system.

(22-43) 2. Give the composition and number and size.

(22-44) 3. Explain abundance of meteor craters on moon and mars while the surface of the earth has so few.

Study Guide - Ch. 22 (continued)

MOON

(22-45) 1. Account for the fact that the same side of the moon is always visible from the earth.

(22-46) 2. List the temperature range, gravitational attraction, atmospheric conditions, diameter and "double planet" effect.

(22-47) 3. Explain the geometry between sun, moon, and earth which results in a lunar exclipse.

(22-48) 4. List probable origin and nature of moon's crust and topographic features.

(22-49) 5. Compare the surface of the moon with that of Mars as indicated from Mariner 6 and 7 photos.

## STUDY GUIDE - Chapter 23 (The Stars)

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After completion of Chapter 23 and review of associated material presented in the lecture, you should be able to:

### SPECTRUM ANALYSIS

(23-1) 1. Give the origin of an absorption spectrum and describe the appearance.

(23-2) 2. Outline how a star's temperature can be measured from its spectrum.

(23-3) 3. Place the relatively hot and cold stars in their appropriate positions in the spectrum.

(23-4) omit 4. Explain how the composition of a star ~~atmosphere~~ can be determined from its spectrum.

(23-5) 5. Describe the manner in which the magnetic field of a star will be revealed by its spectrum.

(23-6) 6. Outline the Doppler effect and show how it can be used to determine the relative motion of a star.

### STARS IN SPACE

(23-7) 1. State how distances to stars are calculated using parallax, including the maximum distance to which parallax can be used and number of stars whose distance can be measured by parallax.

(23-8) 2. Define and contrast intrinsic versus apparent brightness.

(23-9) 3. List the mathematical relationship between apparent and intrinsic brightness.

(23-10) 4. Outline how distances to stars can be calculated knowing the intrinsic and apparent brightness of the stars.

(23-11) 5. Explain the contribution of W. S. Adams to astronomy.

### STELLAR MOTION

(23-12) 1. Contrast the appearance of stars (in terms of direction across the line of sight and Doppler shift) that are moving directly away from, toward or obliquely to the earth.

Study Guide - Ch. 23 continued

DOUBLE STARS

(23-13) 1. Discuss how the mass of a star can be calculated if it is part of a double star.

(23-14) 2. Contrast the narrow range of stellar masses compared with other properties.

VARIABLE STARS

(23-15) 1. Define a variable star.

(23-16) 2. List the two causes of variation.

(23-17) 3. Explain how Cepheid variable stars prove useful to the astronomer.

(23-18) A. Outline the relationship between intrinsic brightness and period of variation.

(23-19) B. Show how the above relationship can be used to measure distances to distant stars.

(23-20) C. Give names of worker first responsible for identification of Cepheid variables and of worker responsible for applying the principle in order to measure stellar distances.

STELLAR PROPERTIES

(23-21) 1. List the range of surface temperatures of stars as indicated by spectrum analysis and also the range of surface temperatures of the great majority of stars.

(23-22) 2. Relate the temperature of stars to color in the visible part of the spectrum.

(23-23) 3. Outline how the diameter of a star can be obtained and summarize the range in stellar diameters.

STELLAR EVOLUTION

(23-24) 1. Discuss the type of spectrum given off by most stars and the gross chemical composition of the stars as indicated by their spectra.

(23-25) 2. Reproduce the Hertzprung--Russell diagram, showing the variation in mass, density, temperature, and brightness.

Study Guide - Ch. 23

STELLAR EVOLUTION (continued)

(23-26) 3. Put the 3 main groups of stars into their appropriate position in the Hertzprung--Russell diagram.

(23-27) 4. Relate position in the H--R diagram to physical properties (i.e., white dwarfs--high T, high density).

(23-28) 5. Outline the gaseous nebula theory.

(23-29) 6. Place the 3 main groups of stars shown in the H--R diagram in the proper stage of probable stellar evolution.

(23-30) 7. Describe the origin and probable evolution of supernovae.

## STUDY GUIDE - Chapter 24 (The Universe)

After completion of Chapter 24 and review of associated material presented in the lecture, you should be able to:

### THE MILKY WAY

(24-1) 1. Outline the shape of the milky way galaxy as viewed from on edge and above.

(24-2) 2. Describe the location of the sun in the milky way.

(24-3) 3. List the width and thickness of the milky way in terms of light years.

(24-4) 4. Give the approximate number of stars in the milky way.

(24-5) 5. Contrast the location, orbits, temperature, and composition of Population I stars with Population II stars.

### STAR CLUSTERS

(24-6) 1. Define a galactic cluster and contrast with globular clusters.

(24-7) 2. List the location, size and number of globular clusters.

### NEBULAE

(24-8) 1. Discuss the location and nature of galactic nebulae.

(24-9) 2. Describe the appearance, position, and spectra of spiral nebulae.

(24-10) 3. Give the approximate number of spiral nebulae and their range in distance (closest and furthest) from the earth.

### GALAXIES (ISLAND UNIVERSES)

(24-11) 1. Compare spiral nebulae to our galaxy in terms of shape, size, motion, and composition.

(24-12) 2. Discuss the nature and probable origin of quasars.

### COSMIC RAYS

(24-13) 1. State in which direction within our atmosphere ionization increases and the conclusion drawn from this phenomenon.

COSMIC RAYS (continued)

(24-14) 2. Define a primary cosmic ray in terms of its velocity, composition and atomic structure.

(24-15) 3. List the effect of the earths magnetic field on incoming primary cosmic rays.

(24-16) 4. List the various types of secondary cosmic rays.

(24-17) 5. Outline the radiocarbon cycle from the combination of nitrogen and a neutron to its migration into living organisms.

(24-18) 6. Account for the unusual energies associated with cosmic rays.

(24-19) 7. Discuss the lack of the effect of abberation on cosmic rays.

EVOLUTION OF THE UNIVERSE

(24-20) 1. State how the Doppler effect can be used to show the universe is expanding.

(24-21) 2. Compare the rate of expansion of the inner and outer portions of the universe.

(24-22) 3. List and discuss the three theories on the creation of the universe.

(24-23) 4. Discuss the probable origin of the earth and our solar system.